

Fall 2009 through Spring 2010



Wisconsin Department of Natural Resources
Bureau of Fisheries Management

Root River Steelhead Facility

Fall 2009 and Spring 2010

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October 2010

Abstract – A total of 1,716 chinook salmon, 1,338 coho salmon, 530 steelhead and 97 brown trout were examined during fall 2009 and spring 2010 at the Root River Steelhead Facility (RRSF). In fall 2009 moderate numbers of coho returned to the facility. Stream flows were relatively high for most of the operating season, and some fish were likely able to bypass the facility. Approximately 1,033,000 coho eggs were collected for our hatcheries. Due to Viral Hemorrhagic Septicemia (VHS) protocols, no skamania strain steelhead brood fish were collected. Historically, adult skamania were transported in the fall from RRSF to Kettle Moraine State Fish Hatchery, where they were held until they were ready to spawn the following January/February. VHS rules now prohibit the transfer of live fish from RRSF to a hatchery.

The spring 2010 return of steelhead was relatively weak, but again, significant numbers of fish were able to bypass the facility during high water events right after ice out and again after considerable rainfall. A total of 218 steelhead were spawned, which produced 321,000 chambers creek eggs and 261,000 ganaraska eggs. In conjunction with eggs collected at the Besadny Anadromous Fisheries Facility, our steelhead egg-take goal was met.

In fall 2009 at RRSF the standard weight of a 30 inch chinook salmon was 9.1 pounds and for a 22 inch coho salmon was 3.5 pounds. These are both higher than fall 2007, which was the lowest standard weight for both species since RRSF opened in fall 1994. The standard weight of a 22 inch steelhead was 3.8 pounds and a 20 inch brown trout was 3.5 pounds.

The fall 2009 estimated population of brown trout in the Root River above RRSF was 523 (\pm 273 SD) and fall steelhead was 297 (\pm 171). Population estimates could not be calculated for the other species due to a low number of recaptures.

The following tables and figures report the results of data collected at the RRSF during fall 2009 and spring 2010. These data contribute to a long-term index of chinook, coho and steelhead populations in the Root River, and are collected to fulfill three objectives: 1) track the abundance of salmonid returns, 2) measure growth and condition of each species and/or strain, and 3) estimate return rate of each species. For complete description of methods and calculations, see Thompson and Eggold (2007).

REFERENCES

Thompson, J. and B. Eggold. 2007. Root River Steelhead Facility, Fall 2006 and Spring 2007. Publication number PUB-FH-836 2007. Wisconsin Department of Natural Resources, Milwaukee, Wisconsin. 22 pages.

Table 1. Summary of Chinook salmon, coho salmon, steelhead and brown trout captured at the Root River Steelhead Facility during 2001 to 2010.

Harvest year	Harvested	Passed upstream	Misc. samples	Total
CHINOOK SALMON				
Fall 2001	432	9,697	84	10,213
Fall 2002	308	9,912	120	10,340
Fall 2003	0	149	0	149
Fall 2004	0	378	0	378
Fall 2005	0	3,608	15	3,623
Fall 2006	482	9,836	0	10,318
Fall 2007	15	3,501	31	3,547
Fall 2008	60	1,413	31	1,504
Fall 2009	0	1,695	21	1,716
COHO SALMON				
Fall 2001	314	942	71	1,327
Fall 2002	221	2,076	217	2,514
Fall 2003	0	126	72	198
Fall 2004	0	1,148	111	1,259
Fall 2005	105	657	79	841
Fall 2006	59	1,133	208	1,400
Fall 2007	249	592	328	1,169
Fall 2008	214	2,071	296	2,581
Fall 2009	185	1,131	22	1,338
STEELHEAD				
Spring 2001	63	790	6	859
Fall 2001	314	176	0	490
Spring 2002	0	1,180	123	1,303
Fall 2002	253	48	0	301
Spring 2003	0	977	83	1,060
Fall 2003	252	6	0	258
Spring, 2004	0	966	62	1,028
Fall 2004	296	77	0	373
Spring 2005	1	819	65	885
Fall 2005	91	25	0	116
Spring 2006	1	784	60	845
Fall 2006	340	196	0	536
Spring 2007	3	305	120	428
Fall 2007	0	98	0	98
Spring 2008	120	121	0	241
Fall 2008	0	10	0	10
Spring 2009	122	902	0	1,024
Fall 2009	0	99	0	99
Spring 2010	67	363	1	431
BROWN TROUT				
Spring 2001	0	2	0	2
Fall 2001	1	176	0	177
Fall 2002	3	291	0	294
Spring 2003	0	1	0	1
Fall 2003	0	53	0	53
Spring 2004	0	3	0	3
Fall 2004	0	28	0	28
Spring 2005	0	6	0	6
Fall 2005	0	141	0	141
Spring 2006	0	1	0	1
Fall 2006	0	124	0	124
Fall 2007	0	242	0	242
Fall 2008	0	243	2	245
Spring 2009	0	1	0	1
Fall 2009	0	95	2	97

Table 2. Number of Chinook salmon harvested, passed upstream and sampled at the Root River Steelhead Facility during fall 2009.

Date	Number Harvested	Number Passed Upstream	Number of Miscellaneous Samples	Total Number of Fish
17-Oct-2009	0	648	9	657
20-Oct-2009	0	278	0	278
21-Oct-2009	0	159	0	159
22-Oct-2009	0	431	6	437
26-Oct-2009	0	139	4	143
28-Oct-2009	0	20	0	20
02-Nov-2009	0	6	0	6
05-Nov-2009	0	7	0	7
12-Nov-2009	0	7	2	9
Totals	0	1,695	21	1,716

Table 3. Average weight, average length, standard weight (predicted weight at a given length based on a length-weight regression) and trophy weight (95th percentile) for the major salmonid species returning to the Root River Steelhead Facility during fall 2000 to spring 2010. The lengths used for calculation of standard weight are: 30 inches for chinook, 22 inches for coho, 22 inches for steelhead, and 20 inches for brown trout.

Season	Number used in analysis	Average weight (pounds)	Average length (inches)	Standard weight	Trophy weight
CHINOOK SALMON					
2000 – 01	536	12.3 ± 5.7	31.1 ± 5.7	9.7	20.0
2001 – 02	672	15.7 ± 5.2	34.3 ± 4.3	10.3	23.5
2002 – 03	538	13.3 ± 4.8	32.8 ± 4.7	9.4	19.9
2003 – 04	-	-	-	-	-
2004 – 05	100	7.9 ± 5.2	26.9 ± 6.3	9.0	16.2
2005 – 06	689	9.3 ± 3.5	29.8 ± 4.4	8.7	14.8
2006 – 07	650	11.7 ± 3.1	32.1 ± 2.8	9.1	17.0
2007 – 08	672	10.4 ± 3.0	31.5 ± 3.4	8.5	15.0
2008 – 09	684	10.1 ± 3.6	30.8 ± 4.5	8.8	15.0
2009 – 10	553	11.4 ± 4.9	31.2 ± 5.2	9.1	18.7
COHO SALMON					
2000 – 01	472	8.2 ± 2.5	27.3 ± 3.2	3.9	11.6
2001 – 02	316	6.8 ± 2.9	25.9 ± 4.9	3.7	10.3
2002 – 03	445	4.8 ± 1.7	23.8 ± 3.0	3.5	7.6
2003 – 04	93	5.1 ± 2.3	23.9 ± 4.7	3.7	8.2
2004 – 05	383	5.7 ± 2.1	25.6 ± 3.5	3.4	9.2
2005 – 06	680	5.4 ± 2.1	24.9 ± 3.8	3.4	8.6
2006 – 07	629	4.0 ± 2.4	22.0 ± 4.8	3.5	8.0
2007 – 08	514	4.6 ± 2.3	23.7 ± 4.8	3.2	8.1
2008 – 09	1,529	5.1 ± 1.6	24.4 ± 2.9	3.5	7.6
2009 – 10	1,217	5.2 ± 2.5	24.2 ± 4.6	3.5	9.0
STEELHEAD					
2000 – 01	482	5.0 ± 1.7	24.1 ± 2.7	3.7	8.4
2001 – 02	674	6.9 ± 2.4	26.9 ± 3.7	3.6	10.5
2002 – 03	526	5.3 ± 2.3	24.5 ± 4.1	3.6	9.4
2003 – 04	576	6.7 ± 2.1	26.7 ± 3.2	4.0	10.5
2004 – 05	764	5.9 ± 2.3	25.6 ± 4.0	3.6	9.5
2005 – 06	541	5.6 ± 1.5	25.4 ± 2.8	3.7	8.1
2006 – 07	771	7.2 ± 2.3	27.4 ± 3.4	3.8	11.1
2007 – 08	318	4.8 ± 2.5	23.9 ± 4.8	3.5	9.5
2008 – 09	622	5.4 ± 1.5	24.8 ± 2.4	3.9	8.3
2009 – 10	528	6.3 ± 1.9	26.5 ± 3.1	3.8	9.2
BROWN TROUT					
2000 – 01	-	-	-	-	-
2001 – 02	95	5.2 ± 1.8	21.9 ± 3.1	3.7	8.2
2002 – 03	156	5.5 ± 1.6	22.5 ± 2.2	4.0	8.0
2003 – 04	44	6.3 ± 2.4	23.6 ± 2.6	4.0	11.7
2004 – 05	30	7.5 ± 3.0	25.3 ± 3.6	4.1	13.8
2005 – 06	76	6.3 ± 2.6	23.4 ± 3.2	3.3	11.8
2006 – 07	80	6.4 ± 2.7	23.7 ± 3.6	3.5	11.0
2007 – 08	60	6.3 ± 1.8	23.7 ± 1.6	3.9	8.5
2008 – 09	243	5.4 ± 1.6	22.8 ± 2.3	3.4	7.8
2009 – 10	95	7.4 ± 3.5	25.1 ± 3.7	3.5	14.9

Table 4. Number of coho salmon harvested, passed upstream and sampled at the Root River Steelhead Facility during fall 2009.

Date	Number Harvested	Number Passed Upstream	Number of Miscellaneous Samples	Total Number of Fish
17-Oct-2009	0	19	0	19
22-Oct-2009	10	164	0	174
26-Oct-2009	70	401	10	481
28-Oct-2009	25	285	7	317
02-Nov-2009	3	35	0	38
05-Nov-2009	70	94	2	166
12-Nov-2009	7	133	3	143
Totals	185	1,131	22	1,338

Table 5. Estimated age composition of coho salmon (sexes combined) examined at the Root River Steelhead Facility during fall, 1995 through 2009. During 1995 to 1998, age was based on age-length key developed from known-age fin-clipped coho salmon. After 1998, ages were assigned by length-frequency of measured fish.

Year of Return	Percent age composition		Number used in analysis	Total return
	1+	2+		
1995	24 %	76 %	1,349	3,321
1996	32 %	68 %	4,170	4,406
1997	5 %	95 %	6,978	7,894
1998	12 %	88 %	2,439	4,000
1999	44 %	56 %	341	1,150
2000	7 %	93 %	472	3,408
2001	16 %	84 %	320	1,327
2002	16 %	84 %	334	2,514
2003	17 %	83 %	93	198
2004	17 %	83 %	363	1,259
2005	20 %	80 %	680	841
2006	48 %	52 %	593	1,400
2007	25 %	75 %	514	1,169
2008	8 %	92 %	1,529	2,581
2009	24 %	76 %	1,217	1,338

Figure 1. Standard weight for the major salmonid species returning to the Root River Steelhead Facility during 1995 to 2009.

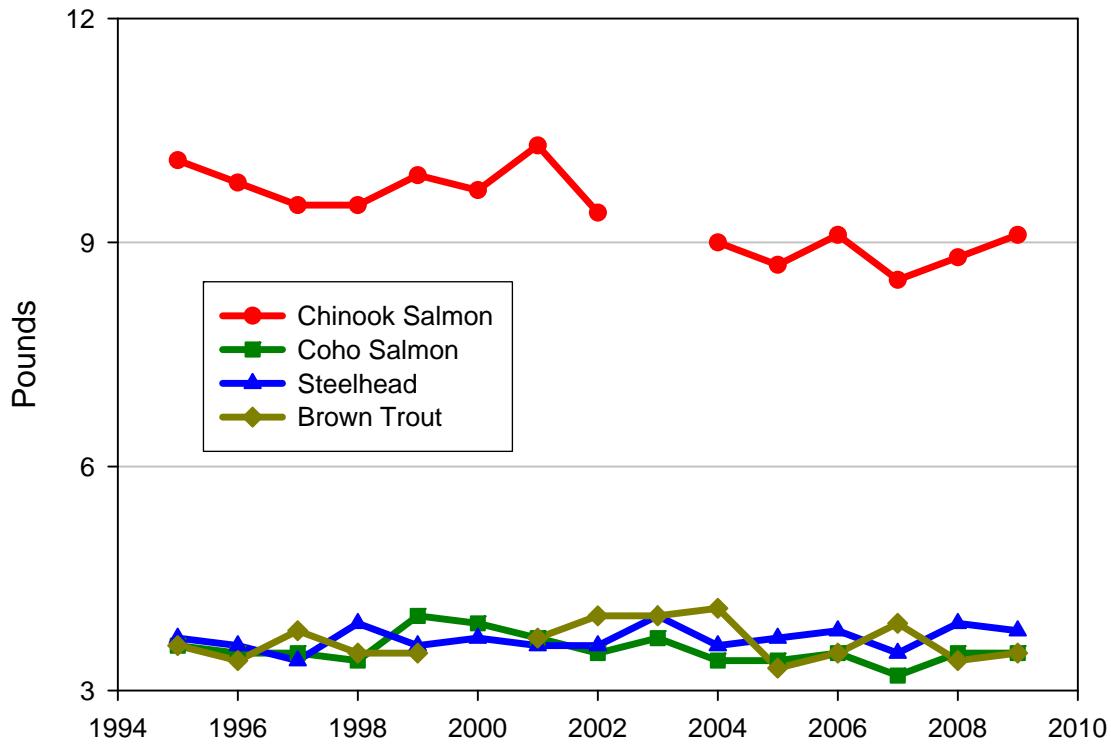


Table 6. Number of steelhead harvested, passed upstream and sampled at the Root River Steelhead Facility during fall 2009 and spring 2010.

Date	Number Harvested	Number Passed Upstream	Number of Miscellaneous Samples	Total Number of Fish
17-Oct-2009	0	3	0	3
22-Oct-2009	0	13	0	13
26-Oct-2009	0	15	0	15
28-Oct-2009	0	34	0	34
02-Nov-2009	0	14	0	14
05-Nov-2009	0	4	0	4
12-Nov-2009	0	16	0	16
29-Mar-2010	0	183	0	183
05-Apr-2010	47	148	0	195
14-Apr-2010	20	32	1	53
Totals	67	462	1	530

Table 7. Return rate of steelhead to the Root River Weir during 1994 through 2010. Number at age were estimated by expanding the proportion at each age in the aged sample against the return of known-strain steelhead. Fall data include only skamania; spring data combine chambers creek and ganaraska returns.

Year Class	Number Stocked	Return Time	Number at Age							Return Rate	
			Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7		
1994	37,347	fall	76	78	87	37	3	14	10	306	0.82%
	72,313	spring	0	299	534	116	133	45	1	1129	1.56%
	109,660	total	76	377	621	154	136	59	12	1435	1.31%
1995	34,254	fall	0	27	25	31	12	39	43	178	0.52%
	69,983	spring	0	25	111	807	216	19	21	1199	1.71%
	104,237	total	0	52	136	838	228	59	64	1377	1.32%
1996	35,262	fall	0	0	18	84	20	8	3	133	0.38%
	70,225	spring	0	47	850	815	10	9	0	1731	2.47%
	105,487	total	0	47	868	899	30	17	3	1864	1.73%
1997	37,484	fall	0	0	46	5	5	2	0	58	0.15%
	66,735	spring	0	38	323	61	18	6	8	455	0.68%
	104,219	total	0	38	369	66	23	8	8	513	0.49%
1998	35,528	fall	0	5	231	156	30	10	6	438	1.23%
	53,914	spring	0	122	578	723	146	19	3	1591	2.95%
	89,442	total	0	127	809	879	176	29	3	2029	2.3%
1999	37,010	fall	0	5	77	41	2	7	6	138	0.37%
	54,405	spring	0	25	245	107	15	4	2	398	0.73%
	91,415	total	0	30	322	148	17	11	8	536	0.59%
2000	35,247	fall	8	0	154	130	1	9	3	305	0.87%
	54,160	spring	0	42	403	444	100	4	13	1006	1.86%
	89,407	total	8	42	557	574	101	13	16	1311	1.47%
2001	33,634	fall	0	38	103	8	75	27	-	251	0.75%
	54,189	spring	0	100	323	376	268	76	2	1145	2.11%
	87,823	total	0	138	426	384	343	103	2	1396	1.59%
2002	35,448	fall	0	2	85	117	0	-	-	204	0.58%
	54,273	spring	0	12	106	129	27	4	2	280	0.52%
	89,721	total	0	14	191	246	27	4	2	484	0.54%
2003	35,145	fall	0	0	268	4	-	2	-	274	0.78%
	58,920	spring	0	101	270	97	18	5	3	494	0.84%
	94,065	total	0	101	538	101	18	7	3	768	0.82%
2004	35,930	fall	0	3	29	-	1	-	-	33	0.09%
	55,033	spring	0	30	73	18	16	5	-	142	0.26%
	90,963	total	0	33	102	18	17	5	-	175	0.19%
2005	34,452	fall	0	3	-	14	-	-	-	17	0.05%
	54,346	spring	0	60	90	133	32	-	-	315	0.58%
	88,798	total	0	63	90	147	32	-	-	332	0.37%
2006	35,210	fall	0	-	63	-	-	-	-	63	0.00%
	57,934	spring	0	67	486	191	-	-	-	744	1.28%
	93,144	total	0	67	549	191	-	-	-	807	0.87%
2007	34,556	fall	-	2	-	-	-	-	-	2	0.01%
	47,628	spring	2	13	36	-	-	-	-	51	0.11%
	82,184	total	2	15	36	-	-	-	-	53	0.06%
2008	0	fall	0	-	-	-	-	-	-	0	0.00%
	84,275	spring	0	14	-	-	-	-	-	14	0.02%
	84,275	total	0	14	-	-	-	-	-	14	0.02%

Table 8. Estimated age composition of steelhead (sexes combined) examined at the Root River Steelhead Facility during 1994 – 2010. Age is based on age-length key developed from known-age fin clipped steelhead. Total number represents the number of steelhead used in the analysis.

Year of return	1+	2+	3+	4+	5+	6+	7+	Total Number
Fall – 1994	8.9	7.5	43.2	34.2	6.2	-	-	146
Spring – 1995		7.3	31.3	38.0	12.7	10.7	-	450
Fall – 1995	15.6	12.2	21.8	49.7	0.7	-	-	147
Spring – 1996		11.0	36.1	33.1	9.1	10.1	0.6	692
Fall – 1996	-	26.3	36.8	5.3	31.6	-	-	21
Spring – 1997		1.0	22.1	42.5	22.5	10.5	1.4	483
Fall – 1997	-	4.4	14.2	67.2	9.6	4.4	-	135
Spring – 1998		15.3	35.9	37.6	5.6	5.2	0.4	287
Fall – 1998	-	-	29.3	44.0	25.3	1.4	-	75
Spring – 1999		2.1	46.5	44.2	7.3	-	-	385
Fall – 1999	-	-	32.3	54.7	5.2	7.8	-	51
Spring – 2000		8.0	21.3	53.6	14.2	3.0	-	714
Fall – 2000	-	2.7	25.3	46.7	6.7	8.0	10.7	75
Spring – 2001		3.5	83.2	8.9	1.4	2.8	0.2	482
Fall – 2001	2.4	1.4	72.8	1.5	13.3	26.3	7.0	212
Spring – 2002		4.2	23.2	68.3	1.5	0.8	2.0	575
Fall – 2002	-	-	26.8	53.9	1.7	2.7	14.8	278
Spring – 2003		13.1	52.9	14.1	19.2	0.8	-	491
Fall – 2003	-	14.1	57.6	15.3	11.1	0.8	1.1	262
Spring – 2004		1.5	39.2	54.0	1.8	2.3	1.0	385
Fall – 2004	-	0.8	41.6	52.8	0.8	4.0	-	125
Spring – 2005		14.7	15.3	54.5	14.5	0.6	0.4	490
Fall – 2005	-	-	79.8	7.3	0.1	6.4	5.5	109
Spring – 2006		4.2	38.4	18.4	38.1	0.6	0.3	354
Fall – 2006	-	0.6	55.6	24.2	15.6	1.9	1.3	475
Spring – 2007		17.4	21.1	28.0	7.8	22.0	3.7	218
Fall – 2007	-	4.8	43.5	6.5	-	40.4	4.8	62
Spring – 2008		34.6	46.2	9.3	6.6	2.2	1.1	182
Spring – 2009	0.3	1.9	73.5	20.1	2.4	0.8	0.3	370
Fall – 2009	-	2.8	76.4	16.7	1.4	2.8	-	72
Spring – 2010		5.0	12.8	68.0	11.4	1.8	1.1	281

Table 9. Average length (inches) and weight (pounds) at age (± 1 SD) of fall-run skamania-strain steelhead at the Root River Steelhead Facility during 1994 to 2009. Data from 2000 - 2004 were taken from fish transported and held at Kettle Moraine Springs Hatchery, so some weight loss likely occurred.

Season	Strain	Age 2+	Age 3+	Age 4+	Age 5+	Age 6+	Age 7+
Fall 1994	Skamania	23.6 (± 0) 4.5 (± 0) N = 1	26.1 (± 1.8) 5.6 (± 1.1) N = 52 / 43	29.9 (± 1.8) 8.3 (± 1.5) len N = 40	31.9 (± 2.7) 10.2 (± 2.2) len N = 13	33.6 (± 1.0) 11.6 (± 1.3) N = 11 wt N = 31 wt N = 12	
Fall 1995	Skamania	25.8 (± 1.0) 5.3 (± 0.8) N = 14	27.0 (± 1.5) 6.2 (± 1.1) N = 27	30.5 (± 2.0) 9.1 (± 2.1) N = 70	31.7 (± 1.1) 10.5 (± 1.4) N = 6		
Fall 1996	Skamania	22.1 (± 0) 4.0 (± 0) N = 1	27.2 (± 1.4) 6.7 (± 0.7) N = 7	28.8 (± 0) 8.0 (± 0) N = 1	32.1 (± 1.7) 10.1 (± 1.8) N = 2		
Fall 1997	Skamania	28.5 (± 1.0) 7.1 (± 0.9) N = 6	27.1 (± 1.1) 6.0 (± 1.0) len N = 19	31.1 (± 1.8) 9.1 (± 1.9) N = 91	32.1 (± 1.3) 9.6 (± 1.1) N = 12	34.5 (± 1.7) 12.3 (± 3.3) N = 7	36.0 (± 0) 12.9 (± 0) N = 1
Fall 1998	Skamania						
Fall 1999	Skamania						
Fall 2000	Skamania	26.4 (± 0) 7.0 (± 1.4) N = 2	27.8 (± 1.2) 7.5 (± 1.0) N = 19	30.2 (± 2.0) 8.5 (± 2.0) len N = 37	28.9 (± 0.5) 8.6 (± 1.0) N = 8	31.2 (± 1.0) 10.6 (± 1.8) N = 6	32.3 (± 2.3) 10.1 (± 1.8) N = 8
Fall 2001	Skamania						
Fall 2002	Skamania						
Fall 2003	Skamania	25.4 (± 1.6) 6.3 (± 1.7) N = 10	26.1 (± 1.9) 6.4 (± 1.2) N = 66	29.5 (± 1.4) 8.6 (± 1.0) N = 16	32.1 (± 2.4) 10.9 (± 1.8) N = 17	30.7 7.5 N = 1	
Fall 2004	Skamania	24.0 (± 0) 4.4 (± 0) N = 1	26.3 (± 2.1) 6.2 (± 1.3) N = 52	29.2 (± 1.7) 7.9 (± 1.5) N = 66	31.8 (± 0) 10.1 (± 0) N = 1	32.5 (± 2.6) 10.0 (± 1.6) N = 5	
Fall 2005	Skamania						
Fall 2006	Skamania	27.3 ($\pm .6$) 6.0 (± 1.5) N = 4	27.3 (± 1.2) 7.0 (± 1.0) N = 262	30.2 (± 1.7) 9.4 (± 1.8) N = 114	29.7 (± 1.4) 8.7 (± 1.6) N = 81		32.0 (± 1.0) 11.6 (± 1.3) N = 6
Fall 2007	Skamania						
Fall 2008	Skamania						
Fall 2009	Skamania						

Table 10. Average length (inches) and weight (pounds) at age (\pm 1 SD) of spring-run chambers creek-strain steelhead at the Root River Steelhead Facility during 1995 to 2010.

Season	Strain	Age 2+	Age 3+	Age 4+	Age 5+	Age 6+	Age 7+
Spring 1995	Chambers Cr.	20.9 (\pm 1.1) 4.2 (\pm 1.1) N = 3	23.9 (\pm 1.7) 4.6 (\pm 1.1) N = 73	28.1 (\pm 1.4) 7.6 (\pm 1.2) N = 89	28.5 (\pm 1.4) 7.8 (\pm 1.3) N = 32	31.3 (\pm 0.9) 10.0 (\pm 1.1) N = 25	
Spring 1996	Chambers Cr.	18.5 (\pm 0.8) 2.2 (\pm 0.3) N = 22	25.2 (\pm 1.4) 5.6 (\pm 1.1) N = 87	27.9 (\pm 1.4) 7.4 (\pm 1.2) N = 90	29.5 (\pm 1.8) 9.3 (\pm 1.6) N = 52	31.2 (\pm 1.3) 10.5 (\pm 1.5) N = 41	32.0 (\pm 0.6) 12.0 (\pm 0.7) N = 3
Spring 1997	Chambers Cr.		24.8 (\pm 1.3) 5.3 (\pm 1.0) N = 33	28.6 (\pm 1.9) 8.3 (\pm 1.5) N = 77	27.4 (\pm 1.6) 6.6 (\pm 1.5) N = 70	32.2 (\pm 1.1) 11.2 (\pm 1.6) N = 35	
Spring 1998	Chambers Cr.		23.8 (\pm 1.4) 4.3 (\pm 0.8) N = 42	27.7 (\pm 2.3) 7.0 (\pm 2.0) N = 39	28.9 (\pm 1.8) 7.5 (\pm 1.2) N = 5	32.1 (\pm 0.8) 10.2 (\pm 1.3) N = 7	
Spring 1999	Chambers Cr.	18.6 (\pm 0.4) 2.7 (\pm 0.8) N = 2	23.8 (\pm 1.6) 4.7 (\pm 0.8) N = 13	28.3 (\pm 2.0) 7.6 (\pm 1.3) N = 96	28.6 (\pm 2.3) 8.0 (\pm 1.8) N = 4		
Spring 2000	Chambers Cr.	17.2 (\pm 1.1) 1.6 (\pm 0.3) N = 12	26.2 (\pm 1.8) 6.3 (\pm 1.1) N = 26	29.3 (\pm 1.8) 8.3 (\pm 1.4) N = 90	29.8 (\pm 2.2) 8.7 (\pm 1.8) N = 54	30.3 (\pm 1.5) 8.6 (\pm 1.9) N = 8	
Spring 2001	Chambers Cr.		23.9 (\pm 1.6) 4.7 (\pm 0.8) N = 62	27.5 (\pm 3.3) 6.9 (\pm 2.0) N = 8	31.3 (\pm 0) 10.7 (\pm 0) N = 1	27.8 (\pm 0.4) 7.1 (\pm 0.5) N = 4	
Spring 2002	Chambers Cr.		25.5 (\pm 1.8) 5.4 (\pm 1.1) N = 17	28.9 (\pm 1.8) 8.0 (\pm 1.6) N = 206	30.3 (\pm 2.4) 9.8 (\pm 1.4) N = 2	29.9 (\pm 2.3) 8.7 (\pm 1.6) N = 2	32.3 (\pm 1.3) 11.2 (\pm 1.8) N = 8
Spring 2003	Chambers Cr.	16.9 (\pm 1.4) 1.8 (\pm 0.4) N = 20	24.8 (\pm 1.3) 5.1 (\pm 1.0) N = 72	28.2 (\pm 1.5) 7.4 (\pm 1.3) N = 27	28.8 (\pm 2.2) 7.7 (\pm 1.5) N = 19	28.6 (\pm 0.7) 7.1 (\pm 0.4) N = 2	
Spring 2004	Chambers Cr.	16.5 (\pm 1.8) 1.6 (\pm 0.4) N = 3	24.8 (\pm 1.4) 5.4 (\pm 0.9) N = 48	28.6 (\pm 1.8) 7.9 (\pm 1.5) N = 112		31.1 (\pm 1.6) 9.7 (\pm 1.4) N = 5	32.6 (\pm 0.7) 11.0 (\pm 0.7) N = 4
Spring 2005	Chambers Cr.	17.7 (\pm 1.2) 1.9 (\pm 0.3) N = 6	24.3 (\pm 1.1) 4.9 (\pm 0.8) N = 38	27.6 (\pm 1.9) 7.1 (\pm 1.6) N = 81	29.2 (\pm 2.2) 8.1 (\pm 1.9) N = 21	28.9 (\pm 1.7) 7.8 (\pm 0.7) N = 3	
Spring 2006	Chambers Cr.	17.9 (\pm 0.7) 2.1 (\pm 0.3) N = 5	23.5 (\pm 1.4) 4.8 (\pm 0.9) N = 22	27.1 (\pm 1.5) 6.6 (\pm 1.0) N = 49	25.5 (\pm 1.2) 5.6 (\pm 0.9) N = 115		32.4 (\pm 0) 9.5 (\pm 0) N = 1
Spring 2007	Chambers Cr.	18.0 (\pm 1.0) 2.0 (\pm 0.4) N = 29	25.8 (\pm 1.3) 5.6 (\pm 1.0) N = 14	26.8 (\pm 1.1) 6.5 (\pm 0.9) N = 34	27.8 (\pm 1.2) 7.1 (\pm 0.5) N = 7	29.6 (\pm 1.0) 8.2 (\pm 1.0) N = 55	29.7 (\pm 0.8) 8.5 (\pm 1.8) N = 2
Spring 2008	Chambers Cr.	18.0 (\pm 1.0) 2.1 (\pm 0.9) N = 21	23.9 (\pm 1.5) 4.4 (\pm 0.7) N = 61	28.5 (\pm 1.9) 7.2 (\pm 1.3) N = 13	25.2 (\pm 2.2) 5.3 (\pm 1.3) N = 4		30.8 (\pm 0.5) 7.7 (\pm 1.1) N = 2
Spring 2009	Chambers Cr.	22.9 (\pm 1.0) 4.3 (\pm 0.8) N = 6	24.8 (\pm 1.5) 5.1 (\pm 0.9) N = 115	27.3 (\pm 1.9) 6.9 (\pm 1.4) N = 62	28.4 (\pm 1.3) 7.8 (\pm 0.9) N = 5	29.9 (\pm 0.9) 8.0 (\pm 1.1) N = 2	33.7 (\pm 0) 12.5 (\pm 0) N = 1
Spring 2010	Chambers Cr.	18.0 (\pm 0.7) 2.0 (\pm 0.1) N = 5	24.5 (\pm 1.9) 4.6 (\pm 0.3) N = 8	27.9 (\pm 2.0) 6.8 (\pm 1.3) N = 102	28.6 (\pm 2.0) 7.3 (\pm 1.7) N = 22	29.0 (\pm 2.0) 7.7 (\pm 0.7) N = 3	34.0 (\pm 1.4) 12.1 (\pm 1.5) N = 2

Table 11. Average length (inches) and weight (pounds) at age (\pm 1 SD) of spring-run ganaraska-strain steelhead at the Root River Steelhead Facility during 1995 to 2010.

Season	Strain	Age 2+	Age 3+	Age 4+	Age 5+	Age 6+	Age 7+
Spring 1995	Ganaraska	16.5 (\pm 1.3) 1.5 (\pm 0.5) N = 30	21.5 (\pm 2.3) 3.3 (\pm 1.0) len N = 68	24.2 (\pm 2.2) 5.0 (\pm 1.4) N = 81	27.5 (\pm 1.7) 7.2 (\pm 2.0) N = 24	28.8 (\pm 1.2) 8.0 (\pm 1.4) N = 23	32.5 (\pm 0) 12.5 (\pm 0) N = 1
				wt N = 67			
Spring 1996	Ganaraska	16.6 (\pm 1.9) 1.7 (\pm 0.5) N = 57	23.5 (\pm 1.8) 4.7 (\pm 1.2) N = 167	25.1 (\pm 2.0) 5.7 (\pm 1.4) N = 113	26.7 (\pm 1.9) 7.1 (\pm 1.5) N = 22	28.6 (\pm 1.5) 8.7 (\pm 1.5) N = 29	32.2 (\pm 0) 12.5 (\pm 0) N = 1
Spring 1997	Ganaraska	15.1 (\pm 1.9) 1.2 (\pm 0.4) N = 3	23.5 (\pm 2.1) 4.3 (\pm 1.3) N = 75	28.4 (\pm 1.9) 7.9 (\pm 1.6) N = 125	27.7 (\pm 2.1) 7.4 (\pm 1.7) N = 30	27.1 (\pm 0) 6.7 (\pm 0) N = 1	
Spring 1998	Ganaraska	16.7 (\pm 1.3) 1.6 (\pm 0.3) N = 45	21.4 (\pm 1.9) 3.3 (\pm 0.8) N = 66	25.1 (\pm 2.6) 5.2 (\pm 1.5) N = 94	27.0 (\pm 0.8) 5.9 (\pm 0.6) N = 7	31.2 (\pm 0.2) 9.3 (\pm 0.7) N = 3	30.4 (\pm 0) 4.9 (\pm 0) N = 1
Spring 1999	Ganaraska	17.1 (\pm 1.6) 2.0 (\pm 0.6) N = 6	23.7 (\pm 1.4) 4.9 (\pm 0.9) N = 167	26.2 (\pm 1.7) 6.6 (\pm 1.3) N = 79	27.6 (\pm 2.0) 7.4 (\pm 1.8) N = 25		
Spring 2000	Ganaraska	16.8 (\pm 1.6) 1.6 (\pm 0.4) N = 37	25.1 (\pm 2.2) 5.8 (\pm 1.6) N = 73	28.6 (\pm 2.1) 8.3 (\pm 1.9) N = 202	28.3 (\pm 2.3) 8.2 (\pm 2.1) N = 18	29.4 (\pm 1.7) 9.0 (\pm 1.1) N = 5	
Spring 2001	Ganaraska	16.9 (\pm 0.6) 1.6 (\pm 0.3) N = 14	23.7 (\pm 1.5) 4.7 (\pm 0.8) N = 273	27.1 (\pm 2.4) 7.0 (\pm 2.1) N = 18	29.3 (\pm 1.0) 9.0 (\pm 0.6) N = 3	28.9 (\pm 1.3) 8.7 (\pm 1.7) N = 4	32.8 (\pm 0) 12.5 (\pm 0) N = 1
Spring 2002	Ganaraska	16.0 (\pm 1.6) 1.5 (\pm 0.4) N = 17	23.2 (\pm 1.5) 4.2 (\pm 0.7) N = 86	27.3 (\pm 1.7) 7.1 (\pm 1.4) N = 103	28.1 (\pm 2.4) 8.0 (\pm 2.5) N = 5	28.9 (\pm 0.5) 8.1 (\pm 0.2) N = 2	
Spring 2003	Ganaraska	17.0 (\pm 1.3) 1.9 (\pm 0.8) N = 39	22.8 (\pm 1.7) 4.3 (\pm 1.0) N = 116	27.2 (\pm 2.0) 6.5 (\pm 1.3) N = 23	25.4 (\pm 2.2) 5.8 (\pm 1.7) N = 48		
Spring 2004	Ganaraska	15.6 (\pm 3.3) 1.6 (\pm 1.0) N = 3	23.7 (\pm 1.7) 4.8 (\pm 1.0) N = 103	27.2 (\pm 2.1) 7.1 (\pm 1.5) N = 96	28.4 (\pm 1.5) 8.1 (\pm 1.1) N = 7	30.2 (\pm 0.8) 8.8 (\pm 0.6) N = 4	
Spring 2005	Ganaraska	17.3 (\pm 1.8) 2.0 (\pm 0.6) N = 66	22.7 (\pm 2.2) 4.1 (\pm 1.2) N = 37	26.4 (\pm 1.7) 6.2 (\pm 1.2) N = 186	27.7 (\pm 2.0) 7.1 (\pm 1.6) N = 50		32.6 (\pm 2.0) 10.3 (\pm 0.6) N = 2
Spring 2006	Ganaraska	16.5 (\pm 1.5) 1.6 (\pm 0.5) N = 8	23.8 (\pm 1.9) 4.7 (\pm 0.9) N = 116	24.8 (\pm 1.2) 5.0 (\pm 1.3) N = 3	26.7 (\pm 1.8) 6.0 (\pm 1.3) N = 20	28.9 (\pm 0.5) 7.1 (\pm 1.3) N = 2	
Spring 2007	Ganaraska	18.2 (\pm 3.6) 2.2 (\pm 1.3) N = 8	23.6 (\pm 1.7) 4.6 (\pm 0.9) N = 34	26.2 (\pm 1.9) 6.3 (\pm 1.4) N = 28	28.3 (\pm 3.0) 7.6 (\pm 2.6) N = 3	27.8 (\pm 0.5) 6.6 (\pm 0.5) N = 2	30.1 (\pm 1.6) 8.3 (\pm 1.7) N = 6
Spring 2008	Ganaraska	17.3 (\pm 1.0) 1.8 (\pm 0.3) N = 45	23.0 (\pm 1.1) 4.1 (\pm 0.6) N = 22	24.9 (\pm 1.0) 5.6 (\pm 0.6) N = 3	27.2 (\pm 1.5) 6.3 (\pm 1.0) N = 8	26.6 (\pm 1.0) 5.5 (\pm 2.5) N = 2	
Spring 2009	Ganaraska	17.1 (\pm 0) 1.8 (\pm 0) N = 1	23.2 (\pm 1.4) 4.5 (\pm 0.8) N = 155	25.8 (\pm 1.7) 5.8 (\pm 1.0) N = 15	27.7 (\pm 1.0) 7.8 (\pm 1.3) N = 3	29.5 (\pm 0) 7.5 (\pm 0) N = 1	
Spring 2010	Ganaraska	17.0 (\pm 1.1) 1.8 (\pm 0.3) N = 11	23.8 (\pm 1.8) 4.5 (\pm 1.0) N = 18	26.2 (\pm 1.9) 6.1 (\pm 1.2) N = 91	26.6 (\pm 1.8) 6.1 (\pm 1.4) N = 11	29.3 (\pm 0.6) 9.9 (\pm 1.7) N = 3	33.0 (\pm 0) 10.2 (\pm 0) N = 1

Table 12. Population estimates for chinook, coho and steelhead salmon returning to the Root River during spring 2001 through spring 2010. Fall steelhead are mostly skamania, but may include other strains.

Year	Species	# marked fish	# recaptured fish	# marked fish in recapture sample	Population size (±) 1 SD
Spring 2001	Chambers Creek	128	8	2	384 ± 157
	Ganaraska	475	27	6	$2,137 \pm 769$
Fall 2001	Chinook	9,697	142	82	$16,792 \pm 1,205$
	Coho	942	2	1	$1,413 \pm 471$
	Fall steelhead	175	40	3	$1,794 \pm 762$
	Brown	176	71	1	$6,336 \pm 3,607$
Spring 2002	Chambers Creek	564	15	9	940 ± 198
	Ganaraska	372	14	9	579 ± 115
Fall 2002	Chinook	9,912	178	143	$12,338 \pm 458$
	Coho	2,079	109	38	$5,963 \pm 781$
	Fall Steelhead	48	5	3	72 ± 19
	Brown	291	11	6	534 ± 147
Spring 2003	Chambers Creek	185	8	7	211 ± 28
	Ganaraska	497	19	11	858 ± 168
Fall 2003	Chinook	149	6	5	179 ± 33
	Coho	126	4	3	168 ± 48
	Fall steelhead	6	23	0	144 ± 100
	Brown	53	25	2	663 ± 449
Spring 2004	Chambers Creek	350	20	7	$1,000 \pm 305$
	Ganaraska	421	32	5	$2,694 \pm 1,107$
Fall 2004	Chinook	378	4	1	$1,512 \pm 1,309$
	Coho	1,148	11	10	$1,263 \pm 120$
	Fall steelhead	77	4	3	103 ± 30
	Brown	28	9	0	280 ± 188
Spring 2005	Chambers Creek	224	7	6	261 ± 40
	Ganaraska	388	9	7	499 ± 89
Fall 2005	Chinook	3,608	50	25	$7,216 \pm 1,020$
	Coho	657	3	3	657 ± 0
	Fall steelhead	25	6	0	175 ± 115
	Brown	141	6	0	987 ± 646
Spring 2006	Chambers Creek	321	18	6	963 ± 321
	Ganaraska	321	8	3	856 ± 391
Fall 2006	Chinook	9,836	119	29	$40,362 \pm 6,518$
	Coho	1,133	3	2	$1,511 \pm 378$
	Fall steelhead	125	14	1	938 ± 504
	Brown	124	15	0	$1,984 \pm 1,358$
Spring 2007	Chambers Creek	139	13	1	973 ± 520
	Ganaraska	65	6	0	455 ± 298
	Spring Skamania	17	2	0	51 ± 29
Fall 2007	Chinook	3,501	28	13	$7,540 \pm 1,530$
	Coho	592	3	0	$2,368 \pm 1,450$
	Fall steelhead	98	1	1	98 ± 0
	Brown	242	3	0	968 ± 593
Spring 2008	Chambers Creek	48	6	0	336 ± 219
	Ganaraska	34	6	0	238 ± 155
	Spring Skamania	6	2	0	18 ± 10
Fall 2008	Chinook	987	28	18	$1,535 \pm 216$
	Coho	2,071	7	2	$5,523 \pm 2,183$
	Brown	243	1	1	243 ± 0
Spring 2009	Chambers Creek	278	7	1	$1,112 \pm 556$
	Ganaraska	260	6	2	607 ± 229
Fall 2009	Fall steelhead	99	2	0	297 ± 171
	Brown	95	10	1	523 ± 273

Figure 2. Steelhead mean length-at-age at the Root River Steelhead Facility during 1996 to 2010. Skamania data from 2001 - 2004 were taken from fish transported and held at Kettle Moraine Springs Hatchery.

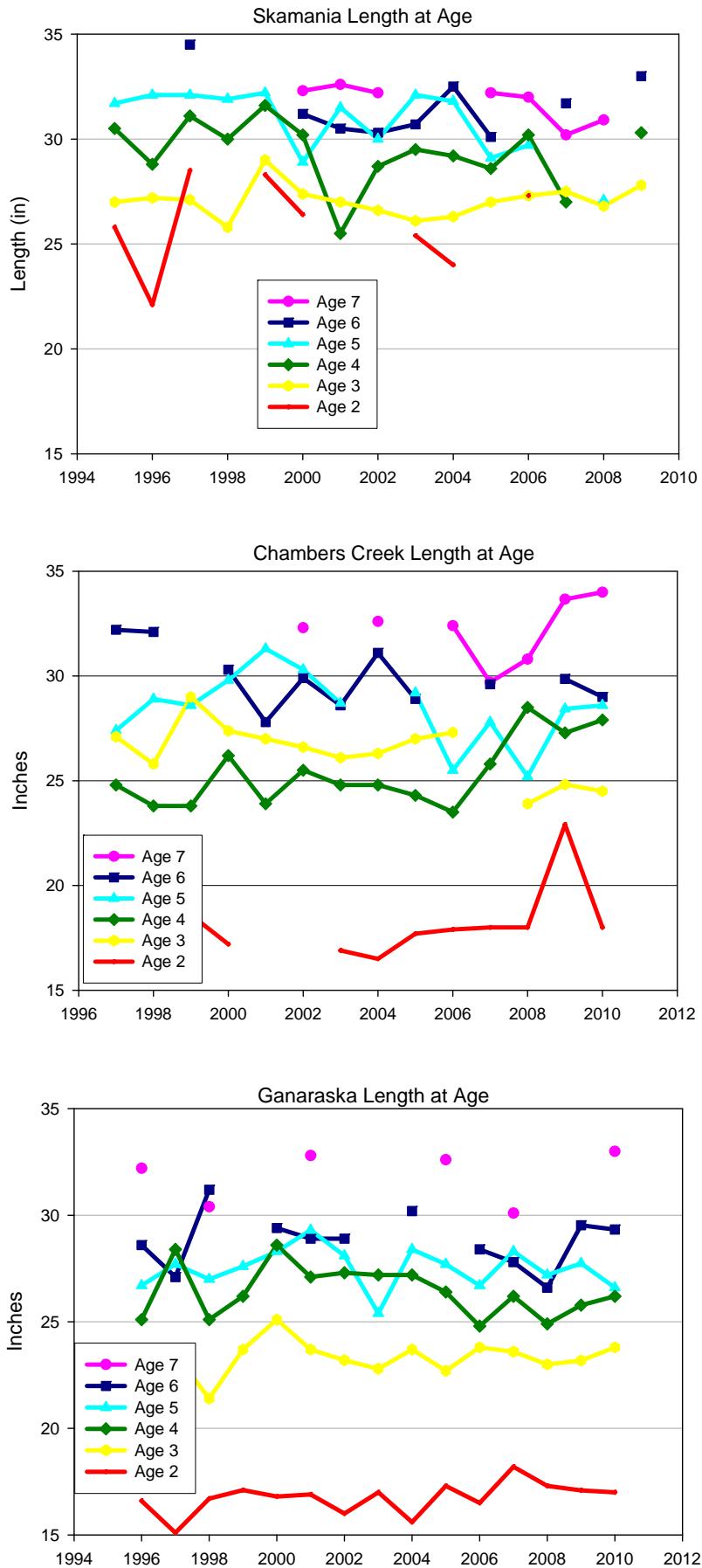
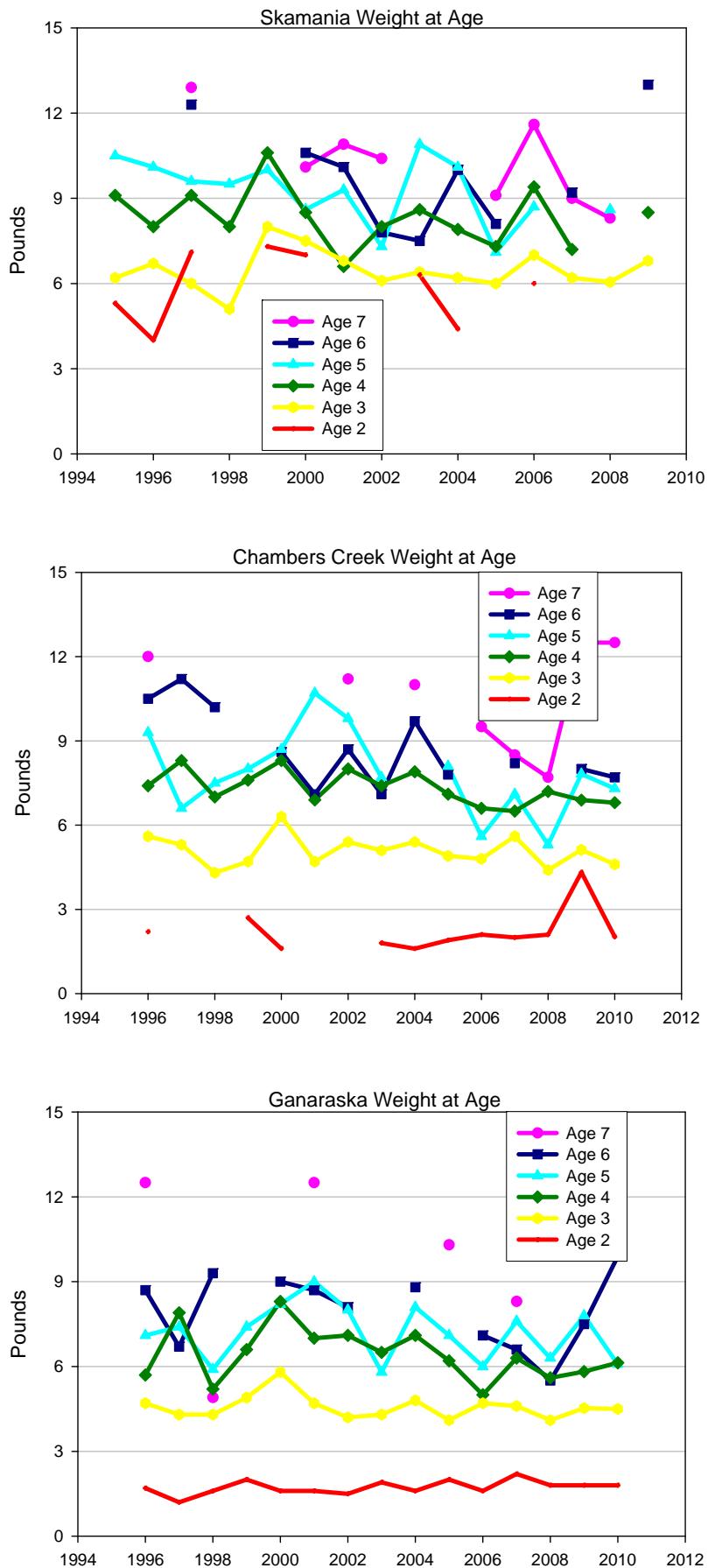


Figure 3. Steelhead mean weight-at-age at the Root River Steelhead Facility during 1996 to 2010. Skamania data from 2001- 2003 were taken from fish transported and held at Kettle Moraine Springs Hatchery.



APPENDIX A. ROOT RIVER STOCKING NUMBERS

Table A-1. Number of fingerling chinook salmon stocked in the Root River during 1994 - 2010. Chinook salmon were marked with an oral dose of Oxytetracycline (OTC) during 2001 and 2006 - 2010. Totals for 1999 and 2006 represent reductions in statewide stocking quotas, and the totals for 2007 - 2010 represents a reallocation to decrease chinook stocking by 33,000 in the Root River in order to increase coho by 33,000.

Year stocked	Total number	Strain	Fin clip
1994	75,533	Lake Michigan	LP
	60,000	Lake Michigan	None
1995	99,000	Lake Michigan	RP
	69,250	Lake Michigan	None
1996	158,000	Lake Michigan	None
1997	142,500	Lake Michigan	None
1998	161,500	Lake Michigan	None
1999	143,100	Lake Michigan	None
2000	142,900	Lake Michigan	None
2001	143,973	Lake Michigan	None (OTC)
2002	140,280	Lake Michigan	None
2003	143,935	Lake Michigan	None
2004	143,900	Lake Michigan	None
2005	144,035	Lake Michigan	None
2006	113,945	Lake Michigan	None (OTC)
2007	80,972	Lake Michigan	None (OTC)
2008	69,000	Lake Michigan	None (OTC)
2009	80,950	Lake Michigan	None (OTC)
2010	44,156	Lake Michigan	A-CWT (OTC)
	41,588		A-CWT (non-OTC)

Table A-2. Number of coho salmon stocked in the Root River during 1994 – 2010. Targets were 40,600 spring yearlings and 10,000 fall fingerings. In 2007 target was changed to 73,600 spring yearlings and 10,000 fall fingerlings.

Year stocked	Total number	Strain	Fin clip	Age
1994	66,080	Lake Ontario	None	Spring yearling 1+
	55,954	Lake Ontario	RMLP	Fall fingerling 0+
	50,389	Lake Michigan	RP	Spring yearling 1+
1995	65,100	Lake Michigan	RMRP	Spring yearling 1+
	54,832	Lake Michigan	RMLV	Fall fingerling 0+
1996	40,590	Lake Michigan	RMRV	Spring yearling 1+
	63,697	Lake Michigan	LP	Fall fingerling 0+
1997	48,107	Lake Michigan	RP	Spring yearling 1+
	6,668	Lake Michigan	REL	Spring yearling 1+
	4,208	Lake Michigan	None	Spring yearling 1+
	20,604	Lake Michigan	None	Fall fingerling 0+
1998	33,666	Lake Michigan	None	Spring yearling 1+
	10,000	Lake Michigan	None	Fall fingerling 0+
1999	45,945	Lake Michigan	None	Spring yearling 1+
	13,824	Lake Michigan	None	Fall fingerling 0+
2000	41,375	Lake Michigan	None	Spring yearling 1+
	10,030	Lake Michigan	None	Fall fingerling 0+
2001	27,970	Lake Michigan	None	Spring yearling 1+
	11,080	Lake Michigan	A-CWT	Spring yearling 1+
	10,260	Lake Michigan	None	Fall fingerling 0+
2002	29,954	Lake Michigan	None	Spring yearling 1+
	10,648	Lake Michigan	A-CWT	Spring yearling 1+
	12,285	Lake Michigan	None	Fall fingerling 0+
2003	31,514	Lake Michigan	None	Spring yearling 1+
	10,845	Lake Michigan	A-CWT	Spring yearling 1+
2004	40,623	Lake Michigan	None	Spring yearling 1+
	14,500	Lake Ontario	None	Fall fingerling 0+
2005	9,755	Lake Ontario	A-CWT	Spring yearling 1+
	30,855	Lake Ontario	None	Spring yearling 1+
	12,739	Lake Michigan	None	Fall fingerling 0+
2006	36,510	Lake Michigan	None	Spring yearling 1+
	7,560	Lake Michigan	A-CWT	Spring yearling 1+
	10,000	Lake Michigan	None	Fall fingerling 0+
2007	61,888	Lake Michigan	None	Spring yearling 1+
	10,000	Lake Michigan	A-CWT	Spring yearling 1+
	29,188	Lake Michigan	None	Fall fingerling 0+
2008	56,697	Lake Michigan	None	Spring yearling 1+
	10,813	Lake Michigan	A-CWT	Spring yearling 1+
	11,369	Lake Michigan	None	Fall fingerling 0+
2009	63,194	Lake Michigan	None	Spring yearling 1+
	10,463	Lake Michigan	A-CWT	Spring yearling 1+
2010	62,705	Lake Michigan	None	Spring yearling 1+
	10,930	Lake Michigan	A-CWT	Spring yearling 1+

Table A-3. Number of steelhead stocked in the Root River during 1994 – 2010. Stocking targets were 35,000 per strain, reduced to 27,000 Chambers Creek and Ganaraska after 1998. No Skamania were stocked in 2009 – 2010 due to VHS restrictions.

Year stocked	Total number	Strain	Fin clip
1994	30,417	Skamania	RM
	35,124	Chambers Creek	LM
	34,759	Ganaraska	LV
1995	37,347	Skamania	ARM
	37,819	Chambers Creek	ALM
	34,494	Ganaraska	ALV
1996	34,254	Skamania	RM
	34,579	Chambers Creek	LM
	35,404	Ganaraska	ARV
1997	35,262	Skamania	RMRV
	35,024	Chambers Creek	LMLV
	35,201	Ganaraska	BV
1998	37,484	Skamania	ARM
	33,187	Chambers Creek	ALM
	33,548	Ganaraska	ALV
1999	35,528	Skamania	RM
	26,951	Chambers Creek	LM
	26,963	Ganaraska	ARV
2000	37,010	Skamania	RMRV
	27,287	Chambers Creek	LMLV
	27,118	Ganaraska	BV
2001	35,247	Skamania	ARM
	27,060	Chambers Creek	ALM
	27,100	Ganaraska	ALV
2002	33,634	Skamania	RM
	27,064	Chambers Creek	LM
	27,125	Ganaraska	ARV
2003	35,448	Skamania	RMRV
	27,123	Chambers Creek	LMLV
	27,150	Ganaraska	BV
2004	35,145	Skamania	RM
	31,039	Chambers Creek	LM
	27,881	Ganaraska	ALV
2005	35,930	Skamania	ARM
	27,058	Chambers Creek	ALM
	27,975	Ganaraska	ARV
2006	34,452	Skamania	RMRV
	27,398	Chambers Creek	LMLV
	26,948	Ganaraska	BV
2007	35,210	Skamania	RM
	22,890	Chambers Creek	LM
	35,044	Ganaraska	ALV
2008	34,556	Skamania	ARM
	24,839	Chambers Creek	ALM
	22,789	Ganaraska	ARV
2009	34,571	Chambers Creek	LMLV
	49,704	Ganaraska	BV
2010	27,913	Chambers Creek	LM
	28,752	Ganaraska	ALV